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SIBOGA-EXPEDITIE

Siboga-Expeditie

UITKOMSTEN

OP

ZOOLOGISCH, BOTANISCH, OCEANOGRAPHISCH EN GEOLOGISCH GEBIED

VERZAMELD IN

NEDERLANDSCH OOST-INDIË 1899—1900

AAN BOORD **H. M. SIBOGA** ONDER COMMANDO VAN

Luitenant ter zee 1e kl. G. F. TYDEMAN

UITGEGEVEN DOOR

Dr. MAX WEBER
Em. Prof. in Amsterdam, Leider der Expeditie

(met medewerking van de Maatschappij ter bevordering van het Natuurkundig Onderzoek der Nederlandsche Koloniën)

LEIDEN
E. J. BRILL
1937

Siboga-Expeditie
XXVII

THE
BRACHIOPODA OF THE SIBOGA EXPEDITION

BY

J. WILFRID JACKSON, D.Sc., F.G.S. (Manchester Museum) AND G. STIASNY, D.Sc. (Leiden Museum)

With 2 plates

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INTRODUCTION

This memoir contains a description of a collection of Brachiopoda made by the 'Siboga' Expedition during the years 1899 to 1900 in the Malay Archipelago.

The 'Challenger' Expedition crossed this region in 1874 on their journey from Cape York, Australia, via Aru Is, Banda Is, etc., to Basilan Strait (Zamboanga). Davidson, in his Report on the Brachiopoda of that Expedition, in 1880, records seven species under the following names. —

Lingula anatina Lam.,	Low Water at Zamboanga.
Discina stella Gould.	Station 190 (= S. E. of Aru Is.), 49 fathoms.
Discina atlantica King.	Station 194 (= East side of Banda Is.), 200 fathoms.
Terebratula sp.	Station 195 (= Molucca Passage), 825 fathoms.
Terebratulina sp.	Station 201 (= Off Zamboanga, Basilan Strait), 82 fathoms.
Terebratella freilii Dav.	Station 201 (as the last).
Megerlia sanguinea (Chem.).	Stations 212 & 213 (= Reefs of Zamboanga), 10 fathoms.

The *Lingula anatina* is the *Lingula lingua* (Sol.) of our memoir; *Discina stella* may be our *Discinisca keiensis*; *Discina atlantica* is now known as *Pelagodiscus atlanticus* (King); *Terebratula* sp. may be *Gryphus borneoensis* Dall; *Terebratulina* sp. may be *Terebratulina valdiviae* Blochmann; *Terebratella freilii* (in part) may be the *Campages basilanica* Dall of our memoir; and *Megerlia sanguinea* is *Frenulina sanguinolenta* (Gmelin).

The 'Valdivia' Expedition visited the region rather en passant, and one species only, *Terebratulina valdiviae* Blochmann, is recorded from Nias, Sumatra.

In other papers (Fischer, Oehlert, Mortensen, Pannekoek, Stiasny) brief references are made to certain species.

The most exhaustive account of the brachiopods of the region now under review is that of Dall, who, in his annotated list of recent brachiopods in the collection of the United States National Museum

at Washington (1920) records eighteen different species, of which twelve are new. These were obtained mainly from dredgings by the steamers of the United States Fish Commission, now the Bureau of Fisheries. The list is as follows. —

Lingula rostrum (Shaw)	Amboyna.
Lingula translucida Dall.	Java.
Craniscus japonicus (Adams)	Borneo (162 fms); Celebes (484 fms).
Hemithyris döderleini (Dav.)	Borneo (347 fms).
Hemithyris bartschi Dall.	Molucca Pass, (298 fms); Off Jolo (161 fms).
Basiliola pompholyx Dall.	Borneo (305 fms); Celebes (540 fms).
Terebratulina valdiviae Bl.	Molucca Pass. (265 fms).
Terebratulina callinome Dall.	Off Jolo (161 fms); Borneo (347 fms).
Terebratulina reevei Dall.	Off Jolo (20 fms); Borneo 7 stations (175—347 fms).
Terebratulina photina Dall.	Tawi-Tawi Is (340 fms); Celebes (540 fms); Borneo (347 fms).
Gryphus joloensis Dall.	Off Jolo (318 fms); Off Tawi-Tawi Is (230 fms).
Gryphus borneoensis Dall.	Borneo (305 fms); Molucca Pass. (272 fms); Jolo Sea (508 fms).
Gryphus translucidus Dall.	Off Tawi-Tawi Is (49 & 340 fms); Borneo (292 fms); Celebes (540 & 700 fms).
Frenulina sanguinolenta (Gmelin). . .	Off Jolo, 9 stations (19 to 318 fms); Off Tawi-Tawi Is, 4 stations (10 to 24 fms); Off Celebes (37 fms).
Frenulina alcocki (Joubin)	Sulu Sea.
Campages asthenia Dall.	Off Jolo (318 fms); Borneo (347 fms).
Campages basilanica Dall.	Off Basilan (78 fms); Tawi-Tawi Is. (240 fms); Off Jolo (161 fms); Off Celebes (700 fms).
Campages (Jolonica) hedleyi Dall. . .	Off Jolo (318 fms).

The latest paper dealing with Malay brachiopods is that by Leloup (1933) who records two species only under the names *Lingula anatina* Brug. (= *lingua* Sol.), and *Frenulina sanguinea* (Chem) (= *sanguinolenta* Gmelin). The first is from Sumatra; the second, from Banda Neira, 2 to 3 metres, and between Banda Neira and Goenoeng Api, 5 metres.

The material of the 'Siboga' Expedition enables us to compare the brachiopod fauna of the Malay Archipelago with the much richer faunas of the Japanese, Chinese, Philippine and Australian waters.

There are 215½ specimens collected in all, and of these 15 belong to a new species of *Discinisca*. We give below the list of the 'Siboga' brachiopods together with indications of the number of specimens and previous records. —

SPECIES	SPECIMENS	PREVIOUS RECORDS
Lingula lingua (Solander)	25.	All over the Archipelago.
Discinisca keiensis sp. nov.	15.	—
Tegulorhynchia döderleini (Davidson).	2.	Japan, China, Borneo.
Basiliola pompholyx Dall.	31.	Borneo, Celebes.
Terebratulina valdiviae Blochmann . .	16.	Nias, Philippines, Molucca Pass.
Terebratulina photina Dall.	4.	Borneo, Celebes, Philippines.

SPECIES	SPECIMENS	PREVIOUS RECORDS
Terebratulina callinome Dall.	22.	Philippines, Japan, Borneo.
Gryphus borneoensis Dall.	7.	Borneo, Jolo, Molucca Pass.
Gryphus translucidus Dall.	3.	Borneo, Celebes, Tawi-Tawi Isl., Philippines.
Campages asthenia Dall.	8.	Borneo, Philippines.
Campages basilanica Dall.	6.	Japan, China, Philippines, Celebes, Tawi-Tawi Isl.
Jolonica hedleyi Dall.	3.	Off Jolo, Philippines.
Frenulina sanguinolenta (Gmelin). . .	63½.	Australia, Philippines, Archipelago, Pacific Islands.
?Pictothyris sp.	9.	
?Terebratalia sp.	1.	
Total	215½.	

There are 15 different species belonging to 11 different genera. Only one species is new, a species of *Discinisca.* Some forms have only been recorded once before, without illustrations, and with insufficient descriptions. The latter are now amplified and figures given. The most common species in our collection is *Frenulina sanguinolenta,* with 63½ specimens.

Brachiopods have been collected from 30 of the 323 different 'Siboga' stations.

Most specimens are of medium or small size, in contrast with the larger and more resistant specimens recorded from the Australian and New Zealand shallow waters. Many have not attained their adult stage and are extremely brittle. These circumstances did not afford suitable facilities for a thorough study in many cases.

If we consider the list of all 'Siboga' Stations where brachiopods have been collected it is obvious that the localities are not evenly distributed in the Archipelago. The two principal localities are Sulu Islands (with 7 stations) and the Kei Islands (with 6 stations). The other localites are mainly distributed over the eastern half of the Archipelago where there are greater depths, and where the ground is more rocky and the relief of the bottom more variable. In the western half there are fewer localities and none in the Java Sea. Here the sea is shallower, the ground flatter and contains more mud. In the central part of the Archipelago (Molucca Passage and Ceram Sea) there is only one locality indicated. In general the brachiopods are confined to the areas indicated in Böggild's map with yellow colour as deposits of shallow water 0—200 metres depth. The habitat most preferred by the brachiopods is that of coral sand mixed with shells, dead corals and Lithothamnion. A few only are found living in blue mud or on deposits mixed with manganese nodules (*Tegulorhynchia döderleini*). There are, however, forms that live on hard and soft ground (*Discinisca keiensis* sp. nov., *Terebratulina valdiviae, Gryphus borneoensis).* Even the typical shallow water form, *Frenulina sanguinolenta,* is recorded here once from 560 metres on grey mud.

On comparing our list of brachiopods with the lists from neighbouring regions, it is seen at once that, with the exception of one species *(Frenulina sanguinolenta)* which occurs in Australia and has a very wide distribution in the Pacific region, the brachiopod fauna of the Malayan Archipelago is made up of components from the waters of China, Japan and the Philippines. In the two latter regions, however, the fauna is much richer and the forms larger. It is in fact somewhat

difficult to separate the Malayan brachiopod fauna from that of the Philippine region, because the Sulu Archipelago belongs really to the latter. It is strange that not a single recent form recorded from the Archipelago has been found in a fossil state in the Dutch East Indies. Future research may be instrumental in discovering such forms, though the immigration of brachiopods into the Archipelago may only have taken place in fairly recent times. From the small size and brittleness of most of our specimens, it may be deduced that the conditions of life in the Archipelago are not favorable for the brachiopods. We may be dealing here, not with young, but with dwarf specimens. Perhaps this may be due to the comparatively small amount of Ca. C03, recorded by the 'Siboga' Expedition in the deep water layers of the Archipelago.

With regard to depth, most specimens are from a medium depth of 100—520 metres; from shallow waters there are only *Lingula lingua* and *Frenulina sanguinolenta* (with two exceptions for the latter, viz. 400—120 M. and 560 M.); from remarkable depths are *Discinisca* sp. (a very imperfect specimen, from 2798 M.), *Tegulorhynchia döderleini* (possibly a young form, from 1158 M.), a very young example of *Terebratulina valdiviae* from 1264—1165 M., and a fragmentary specimen from 1224 M., an immature specimen of *Gryphus borneoensis*(?) from 1633—1300 M., and *Campages asthenia* from 1264—1165 M.

Concerning the various new forms of Blochmann and Dall, we might point out that imperfect descriptions only, not diagnoses, are given, and, in the case of Dall, there are no figures. Blochmann, in establishing his new species, *Terebratulina valdiviae,* gives a rather superficial description of the shell, says very little about the loop (which according to him is different from the loop of *T. caput-serpentis* = *retusa*), and figures only the spiculation of the mantle. The latter feature, therefore, is the only definite character known of the species at present. Dall gives more extensive descriptions, but the absence of illustrations creates much difficulty in recognising his species. It is not convenient that such descriptions must serve as diagnoses of new species.

The bathymetrical distribution and type of bottom for the 'Siboga' brachiopods follows.

SPECIES	REMARKS	BOTTOM	DEPTH IN METRES
Lingula lingua (Sol.)	Banda Sea.		9—36
	Amboyna.		
	Borneo Bank.	Fine grey coral sand.	59
	Gisser & Ceram Laut.	Coral and Lithothamnion.	18
Discinisca keiensis sp. nov. . . .	Bougainville Str.	Fine and coarse sand with dead shells.	141
	Kei Islands.	Sand, coral and shells.	90
	S.E. of Celebes.	Mud with forams.	2798
	(*Discinisca* sp.).		
Tegulorhynchia döderleini (Dav.).	S. of Celebes.	Pale grey mud.	400—120
	S. of Celebes.	Grey mud.	1158
Basiliola pompholyx Dall.	Sulu Islands.	Coral bottom.	275
	Kei Islands.	Coral sand & dead coral.	487
Terebratulina valdiviae Bl.	Sulu Is.	Sand.	350
	Celebes(N. of Menado)	Stone.	1264—1165

SPECIES	REMARKS	BOTTOM	DEPTH IN METRES
	Bougainville Str.	Muddy sand, shells & Lithothamnion.	83
	Kei Islands.	Hard coral sand.	204
	Kei Islands.	Blue mud.	560
	Kei Islands.	Mud, coral & stones.	596
	Letti Is.	Manganese nodules.	1224
	Rotti Is.	Grey mud.	520
	Sumbawa.	Sand & dead coral.	73
Terebratulina photina Dall . . .	Kei Islands.	Hard coral sand.	204
Terebratulina callinome Dall . .	Sulu Is.	Coral.	275
Gryphus borneoensis Dall . . .	Pearl Banks.	Stones.	522
	Sulu Is.	Coral.	275
	Ceram.	Dead coral and stones.	1633—1300
	Kei Islands.	Blue mud.	560
Gryphus translucidus Dall . . .	Sulu Is.	Coral.	275
Campages asthenia Dall	Timor.	Coral & Stones.	390
	Menado.	Stones.	1264—1165
	Letti Is.	Manganese nodules.	1224
Campages basilanica Dall. . . .	Sulu Is.	Coral.	275
	Kei Islands.	Hard coral sand.	204
Jolonica hedleyi Dall	Sulu Is.	Coral.	275
Frenulina sanguinolenta (Gmelin).	Saleyer.	Mud & coral.	400—120
	Tawi-Tawi Is.	Litho. sand & coral.	8—10
	Sulu Is.	Lithothamnion.	15
	Sulu Is.	Lithothamnion.	16—23
	Sulu Is.	Lithothamnion.	13
	Damar Is.	Coral & Litho.	45
	Kei Islands.	Coral.	52
	Kei Islands.	Sand, coral & shells.	90
	Kei Islands.	Grey mud.	560
?Pictothyris sp.	Sebankatan.		
?Terebratalia sp.	Sulu Is.	Coral.	275

DESCRIPTION OF THE SPECIES

Subclass GASTROCAULIA Thompson, 1927

Order ATREMATA Beecher, 1891

Superfamily Lingulacea Waagen, 1885

Family LINGULIDAE Gray, 1840

1. Genus **Lingula** Cuvier, 1797

1. *Lingula lingua* (Solander, 1786).

DUCK's Bill. *Rostrum anatis,* etc. Humphrey, Nat. Hist. of Shells, 1770, p. 9, pl. II, fig. 2.
Mytilus lingua Solander, Portland Catalogue, 1786, p. 77, no. 1718.
Pinna unguis seu *lingua* Chemnitz, Conch. Cab., Vol. X, 1788, p. 360, pl. 172, figs. 1675—1677.
Lingula (Name only). Bruguière, Encyclo. Method. Tableau, vol. II, 1797, pl. 250, figs. 1 *a—c.*
Lingula Cuvier, Tabl. Elem. Hist. Nat., 1797 (24 Dec.) , p. 435.
Lingula anatina Lamarck, Syst. An. s. Vert., 1801, p. 141.
Des Lingules, Cuvier, Bull. Soc. Philom., I, (1797) published 1803, p. 111, pl. 7, figs. 1 *a. b.*
Mytilus lingua Solander, Dillwyn, Desc. Cat. Rec. Shells, I, 1817, pp. 322—323.
Lingula anatina Lamarck, An. s. Vert., VI, pt. 1, 1819, pp. 257—8.
Lingula anatina Lamarck, Children, Lamarck's Genera of Shells, 1823, p. 78, pl. II, fig. 105.
Lingula anatina Lamarck, Bory de St. Vincent, Explan. of Plates in "Brug." Encyclo. Method, 1824, p. 151.

Banda Sea, 9—36 M. No. 1. 1 specimen.
Amboyna (The type locality). Nos. 2 & 3. Many specimens.
Stat. 77a. Borneo Bank. 59 M. Fine grey coral sand. 1 specimen.
Stat. 172. Between Gisser and Ceram Laut. 18 M.
Coral and Lithothamnion bottom. 4 specimens.

Remarks. — This is the *Lingula anatina* of Lamarck, 1801 and 1819, and of many writers. The species has also been erroneously called *Lingula unguis* (L.) (See Dall, Proc. U. S. Nat. Mus., vol. 57, 1920, pp. 262—3; and Thomson, Brachiopod Morphology and Genera, 1927, p. 124). The *Patella unguis* of Linné (Syst. Nat., ed. 10, 1758, no. 671, p. 783) is based on Rumphius, D'Amb. Rar., 1741, pl. 40, fig. L., which is a *Scutum* (or *Parmophorus*) as pointed out by Hanley in 1855 (Shells of Linnaeus, p. 425, pl. III, fig. 4). This is a gastropod and not a brachiopod. Solander, in his Portland Catalogue, 1786, no. 1718, p. 77, writes, "A large and fine, and two small specimens of *Patella unguis* L. (*Mytilus lingua,* or Duck's Bill Limpet, S) Humphrey's Conchology, pl. 2, fig. 2, from

Amboyna — extremely rare." Humphrey's work was published in 1770 and his figure is certainly that of a *Lingula*. A recent writer, Dr. Leloup (Mem. Mus. Roy. d'hist., nat. Belg., vol. II fasc. 13, April 1933) refers to the species as *Lingula anatina* Bruguière. He gives a very long list of synonyms and references, but many of them are incorrect, especially as regards date and name.

The genus *Lingula* has been attributed to Bruguière by various authors (see Dall, 1920; Thomson, 1927; Schuchert and Le Vene, 1929). In Bruguière (Encyclo. Method., vol. II, 1797, pl. 250, figs. 1 a-c) the name *Lingula* appears at the top of the plate; but this does not conform to the International Rules of Nomenclature, Article 25a, as constituting a genus. The genus was first defined by Cuvier, in 1797 (24th December) in his Tabl. Elem Hist. Nat., (p. 435, *Ligula,* corrected in Index to *Lingula).*

The first use of the specific name *anatina* is by Lamarck, in 1801 (Syst. An. s. Vert., p. 141). A further and more complete description was given by Lamarck in 1819 (An. s. Vert., tome 6, pt. 1, pp. 257—8).

Order NEOTREMATA Beecher, 1891

Superfamily Discinacea Waagen, 1885

Family Discinidae Gray, 1840

Subfamily Discininae Schuchert & Le Vene, 1929

2. Genus Discinisca Dall, 1871

1. *Discinisca keiensis* sp. nov. Pl. I, figs. 13—16.

Stat. 153. Bougainville Strait (near Waigeoe Is.). 141 M. Fine sand, coarse sand with dead shells. No. 5, 5 specimens (all young).

Stat. 221. South of Tukang Besi Is., S.E. of Celebes. 2798 M. Solid bluish grey and brown mud with forams. No. 6, 1 specimen (young and damaged) of *Discinisca* sp.

Stat. 260. North Point of Nuhu Jaan, Kei Is. 90 M. Sand, coral and shells. No. 4, 8 specimens; No. 7, 1 specimen.

Description. — Shell of small size, rounded in outline, with margins more or less irregular; apex of upper valve situated posteriorly, smooth on top, with wide and flat radials and fine interspaces extending from it to the periphery, the number of radials increasing by bifurcation and by interpolation; radials crossed by fine concentric growth-lines. Lower valve with large, heart-shaped peduncular area, extending outwards from which are widely-spaced, straight radial threads. Setae very long, especially in front, nearly as long as the shell.

Size. Length, 7 mm; breath, 7 mm.

Type locality. 'Siboga' Station 260. North point of Nuhu Jaan, Kei Is. Dredged at 90 metres on bottom of sand, coral and shells. One specimen.

Remarks. — This new species differs from the China and Japan Seas *Discinisca stella* (Gould) in the possession of the wide and flat radials with finer interspaces, and in having longer setae. In

general type of sculpture, the species is closely related to *Discinisca indica* Dall from Bombay and Ceylon, but the radials are more definite in character and commence relatively nearer the apex than in *D. indica.* Moreover, according to Dall, *D. indica* has very short setae. The latter, which is also recorded by Dall with some hesitation from the Philippines, has never been figured, and our comparisons have been made with specimens from Tuticorin, 9 fathoms, Madras and Karachi (all in the collection of Mr. R. Winckworth), also with one from the Persian Gulf, dredged by Mr. F. W. Townsend.

There is some variation in the 'Siboga" specimens, mostly due to age. The five specimens, No. 5, from Station 153, measure 2—3 mm. in diameter. The upper valves have fine concentric rings without radials, except the largest which shows them very faintly: on the lower valve the fine radial threads are scarcely visible. The single specimen, No. 6, from Station 221, is 6 mm. in diameter, and is in a damaged condition. It has concentric ornament, but no radials. It is so imperfect that we hesitate in ascribing it to any particular species, and place it in the list as *Discinisca* sp. The eight specimens, No. 4, from Station 260, are 2—7 mm. in diameter. The apical parts have fine concentric rings only, like No. 5. Radials appear later towards the periphery and are well seen on the largest specimen, the lower valve of which shows widely-spaced radials. This specimen also shows the long setae.

The type specimen, No. 7, from Station 260, is 7 mm. in diameter, and agrees with the last. It is figured in this report in two views, viz. the upper and lower valves (Pl. I, figs. 15—16), and comparison should be made with the figure of *Discinisca stella* (Gould) from Japan (not 'Siboga' material: see Pl. I, fig. 12). A specimen of the new species, No. 120, from a group of seven examples from Kei Islands (not 'Siboga' material: collected by H. Boschma) is also figured here (Pl. I, figs. 13—14). This shows the radials of Nos. 4 and 7.

Davidson ('Challenger' Report, 1880, p. 64, pl. IV, figs. 19, 19a) records and figures a *Discinisca,* as *Discina stella* Gould, from the 'Challenger' Station 190, lat. 8° 56′ S., long. 136° 5′ E. (N. in error), 5 upper valves; in 49 fathoms; sea bottom, mud. In some strange manner he refers to the locality as "Off Bermuda", both here and in his 'Recent Brachiopoda' 1888 (p. 239. Description of the Plates: pl. XXVI, figs. 27—29); but the 'Narrative of the Cruise', vol. I, 2nd part, 1885, p. 1012, and plan 31, gives the true location. This is Arafura Sea, south-east of Aru Is. The specimens may belong to our species. Davidson's enlarged figure (fig. 19a) shows a somewhat different type of sculpture from that of the Japanese specimen of *D. stella* figured by him in 1871 (Proc. Zool. Soc., pl. XXX, fig. 5).

The upper valve of *Discinisca stella* (Gould) has numerous fine raised radials with moderately wide and flat interspaces. Some of the radials start from near the apex; others are intercalated later, nearer the margin. The radials are crossed by extremely fine concentric growth-lines (see pl. I, fig. 12).

Davidson ('Recent Brachiopoda', 1888, p. 205) refers to some specimens of *D. stella* with radials so faintly indicated as to make the shell appear smooth, and in that condition it was difficult to distinguish from *Pelagodiscus atlanticus* (King), of cosmopolitan distribution. He does not specify the precise locality. This may be the form described by Dall, in 1920, as *Discinisca sparsilineata,* but, if so, there is some confusion. In his description, Dall says. — "upper valve irregular, nearly without radial sculpture", but the figures cited, viz. Davidson, 'Recent Brachiopoda' pl. 26, figs. 28, 28a, show very distinct radial sculpture.

Subclass PYGOCAULIA Thomson, 1927

Order TELOTREMATA Beecher, 1891

Superfamily Rhynchonellacea Schuchert, 1896

Family Rhynchonellidae Gray, 1848

3. Genus Tegulorhynchia Chapman and Crespin, 1923

1. *Tegulorhynchia döderleini* (Davidson 1886). Pl. II, figs. 28 to 33.

Rhynchonella döderleini Davidson. Ann. Mag. Nat. Hist., ser. 5, vol. 17, 1886, p. 1: Monograph Recent Brachiopoda, pt. 2, 1887, p. 172, fig. 19, and pl. 25, figs. 14—15.
Hemithyris döderleini (Dav.). Dall, Proc. U. S. Nat. Mus., vol. 57, 1920, p. 287.
Tegulorhynchia döderleini (Dav.). Chapman and Crespin, Proc. Roy. Soc. Victoria, vol. 35 (n.s.), pt. II, 1923, p. 186.
Tegulorhynchia döderleini (Dav.). Hatai, The Venus, vol. VI (2), June 1936, pp. 96—104.

Stat. 65a. Djampeja, south of Saleyer Is., south of Celebes. 400—120 metres. Pale grey mud, etc. No. 9, 1 specimen.
Stat. 211. North-east Saleyer Is., south of Celebes. 1158 metres. Coarse grey mud. No. 8, 1 specimen (very juvenile, probably, of this species).

Remarks. — Davidson established this species, in 1886, on a specimen dredged by Dr. L. Döderlein in about 160 fathoms in Sagami Bay, Japan. The species is further recorded by Dall (1920) from Sibuko Bay, Borneo, 347 fms (2 valves); and China Sea, off Pratas Island, in 230 fms (3 valves) and 340 fms (1 valve). Hatai has recently (1936) recorded a single specimen from Station 435, 32° 10′ N., 128° 46′ 45″ E., on the continental shelf bordering the islands of Japan, in 324 metres (about 177 fms) on a bottom of sand and rocks.

The 'Siboga' specimen No. 9, from Station 65a, is very typical of the species and measures: length, 17; width, 20; thickness, 10.4 mm. It is figured here in Plate II, figs. 28—33. The shell is a little asymetrical. Figures 28, 29 and 30 show exterior views and illustrate the shape, folding and ornament. Figure 31 is an enlarged view of the apical portion of the ventral valve showing the foramen, conjunct deltidial plates, and teeth; figure 32 shows the cardinalia consisting of transversely grooved dental-sockets, strong socket-ridges with crural bases closely attached to the inner sides; no inner hinge-plates; short but distinct median septum extending from umbonal part of crural bases; no true cardinal process. Figure 33 is a much enlarged view of a portion of the external surface showing the true character of the ornament.

Davidson's description of the form of the shell of this species is correct in general. With regard to the sculpture of the valves, his text-figures 19 a & b do not agree with his description. He mentions numerous delicate radiating ribs, with interspaces between them of almost equal width, and increasing in number at variable distances from the beaks by the interpolation of shorter riblets. His figure 19a does not show the radiating ribs, but only the transverse ones and spines. Figure 18b does not correspond with the sculpture of our specimen. Davidson says "Valves closely crossed by numerous

equidistant, concentric, raised or foliated lines of growth, giving rise at the margin on each riblet to short sloping or erect hollow spinules, and he figures the spinules the wrong way. As shown in our figure 33, the spinules are short truncated tubes projecting from the anterior edges of the squamose layers of the shell. In Davidson's figure 19b the rows of spines are shown immediately below very fine transverse ridges which terminate the squamose layers, and they are depicted as long tubes narrowing to a point.

The juvenile example, No. 8, from 'Siboga' Station 211, dredged at 1158 metres, is extremely fragile and too small for accurate determination. It was obtained at a greater depth than any of the specimens mentioned by Dall, and may not be this species, but perhaps a *Cryptopora.*

With the exception of the species under review, from northern waters, all other recent and fossil forms of the genus are confined to the southern hemisphere.

4. Genus **Basiliola** Dall, 1908

1. *Basiliola pompholyx* Dall 1920. Pl. I, figs. 6 to 9.

Basiliola pompholyx Dall. Proc. U. S. Nat. Mus., vol. 57, 1920, p. 291.

Stat. 105. Sulu Islands. 275 metres. Coral bottom. No. 36, 6 specimens; No. 10, 19 specimens; No. 11, 5 specimens.
Stat. 259. Kei Islands. 487 metres. Coral sand and dead coral. No. 35, 1 specimen (juvenile).

Remarks. — Dall described this species in 1920 from specimens obtained at Sibuko Bay, Borneo, in 305 fathoms. He also records it from Celebes, 540 fms, and from 9 localities in the Philippines, ranging in depth from 24 to 1105 fms. The deepest is off Eastern Palawan Island, where a single valve was dredged.

The 'Siboga' specimens from Station 105, Sulu Is,. agree closely with one of Dall's type specimens from Sibuko Bay, south of Silungan Is. We are indebted to the Smithsonian Institution, Washington, for the loan of this. The largest of our specimens is in lot No. 11, and is a little distorted: it measures, length, 21; width, 20; thickness, 13 mm., and is somewhat smaller than the type, which is 26 × 28 × 17 mm.

Dall did not figure the species. We therefore give here four views in Plate I. Figures 6, 7 and 8 show the general shape and thickness; figure 9 shows the peculiar labiate (spout-like) foramen and the conjunct deltidial-plates. The foramen is submesothyrid; there are distinct but thin dental plates. In the interior of the dorsal valve there are short crura attached to short and fairly strong crural-bases which are separated clear to the apex; no septum and no cardinal process.

At first glance, the smaller examples of this species present a striking resemblance to the exclusively Japanese *Neohemithyris lucida* (Gould); but the two forms are quite distinct.

The single specimen from Station 259, Kei Is., is very small, but seems to belong to the same species as those from Station 105. The occurrence of the species here extends the range well to the south-east of the type locality.

PACIFIC OCEANIC FISHERY
INVESTIGATIONS

Superfamily Terebratulacea Waagen, 1883

Family Terebratulidae Gray, 1840

Subfamily Cancellothyrinae Thomson, 1926

5. Genus Terebratulina d'Orbigny, 1847

1. *Terebratulina valdiviae* Blochmann 1908.

Terebratulina sp. Davidson, Voyage of H. M. S. Challenger, 1880, p. 36, pl. I, fig. 10.
Terebratulina valdiviae Blochmann. Zeitsch. für Wiss. Zoologie, vol. 90, 1908, pp. 601 and 639, pl. 36, figs. 5—6.
Terebratulina valdiviae Blochmann. Dall, Proc. U. S. Nat. Mus., vol. 57, 1920, pp. 301—2.

Stat. 98. 6° 9′ N., 120° 21′ E. N. Ubian, Sulu Is. 350 metres. Sand. 1 dead shell.
Stat. 122. Celebes Sea. N. of Menado. 1264—1165 metres. Stone bottom, No. 38a, 1 specimen (very young).
Stat. 154. Bougainville Strait. 83 metres. Grey muddy sand, shells and Lithothamnion. No. 15, 1 specimen (young).
Stat. 251 Arafura Sea, near Kei Is. 204 metres. Hard coral sand. No. 23, 2 specimens (young); No. 24, 2 specimens (very young); No. 25, 1 specimen (very young).
Stat. 262. Near Kei Is. 560 metres. Solid bluish mud, upper layer more liquid and brown mud. No. 12, 4 specimens.
Stat. 266. Kei Is. 596 metres. Grey mud with coral and stones. No. 13, 1 specimen; No. 26, 1 specimen (very young).
Stat. 280. West of Letti Is., N. E. of Timor. 1224 metres. Dredge brought up glossy black manganese nodules. No. 17, 1 specimen (fragments).
Stat. 297. East of Rotti (S. W. end of Timor). 520 metres. Soft grey mud. No. 21, 1 specimen (young).
Stat. 310. Flores Sea, east coast of Sumbawa. 73 metres. Sand with few pieces of dead coral. No. 22, 1 specimen.

Remarks. — Davidson, in his description of the brachiopods of the 'Challenger' Expedition (1880) refers to and figures (Dav. pl. I, fig. 10) a specimen of a *Terebratulina* dredged at Station 201 = Off Zamboanga, Basilan Strait, in 82 fathoms. This may be the species under review.

Blochmann's type came from Off Nias, Sumatra, 366 fms. ('Valdivia' Expedition).

Dall, in 1920, added a number of localities ranging from the Gulf of Tartary, through Japan, Korea, China Sea, Philippines, to Molucca Pass, with a doubtful record for Australia. The range of depth given by him is from 65 to 682 fathoms. Having in his possession two cotypes from Blochmann, as well as quite a number of specimens, it is a great pity that Dall did not give a proper diagnosis of the species. All he says is that "this species much resembles *T. unguicula* but is generally a little smaller and flatter, with the outline more triangular. The spiculation is sufficiently different in Blochmann's opinion to separate the species. The tropical distribution also reenforces the argument."

Blochmann, unfortunately, gives no figure of the shell, and his description is, on the whole, very meagre. He figures the spicules only, and seems to base the species entirely on these. He mentions some resemblances and some differences between his species and the Mediterranean form of *Terebra-*

tulina retusa (L.) (= *caput-serpentis* L. [1]); but in his comparison of the spicules he made use of Norwegian examples of the latter instead of those from the Mediterranean region. As pointed out by one of the writers (J. W. J.) in 1921 (Ann. Mag. Nat. Hist., ser. 9, vol. 7, p. 41) this makes the precise relationship between the Mediterranean- and Indian Ocean-forms somewhat uncertain.

The 'Siboga' specimens come from depths not very different from Dall's, viz. 73 metres (about 40 fathoms) to 1264 metres (691 fathoms). Unfortunately, they are very young or small specimens and do not permit of very close study. One of the writers (G. S.) has examined the spicules of some of the 'Siboga' specimens, and has found much variation, some spicules being similar to those of *T. retusa* and others not so close. The 'Siboga' specimens from the greatest depth are, unfortunately, imperfect. Those from Station 280, taken at 1224 metres, consist of three fragments of shell; that from Station 122, dredged at 1264—1165 metres, is a very young example. Little can be said of these. They are possibly *T. valdiviae,* to which species we have referred the others, pending further dredgings in this region and the acquisition of larger and better specimens. We for these reasons cannot give here neither a satisfactory diagnosis of this species.

2. *Terebratulina photina* Dall 1920. Pl. I, figs. 17, 18, 18a.

Terebratulina photina Dall. Proc. U. S. Nat. Mus., vol. 57, 1920, pp. 309—310.

Stat. 251. Arafura Sea (Kei Is.). 204 metres. Hard coral sand. No. 20, 1 specimen; No. 42, 3 specimens (1 very young).

Remarks. — Dall's types were described from Sibuko Bay, Borneo, off Sipadan Island, 347 fathoms, in mud. He also records the species from Celebes, 540 fms, and Tawi-tawi Islands, Philippines, 340 fms. He gives no figures.

The 'Siboga' specimen, No. 20, which measures, length, 15; width, 12; thickness, 6 mm., seems to us to agree with Dall's description (Pl. I, figs. 17, 18, 18a). It is remarkably like a *Gryphus* in its smooth and glassy appearance. The complete loop, however, shows it to be a *Terebratulina.* The punctation is dense and conspicuous, and the shell-surface shows only a few hair-like striae under high magnification.

One of the specimens, No. 42, shows the dorsal valve to have the distinct loop of *Terebratulina.* In the ventral valve there is a good pedicle-collar, but no dental plates are present. Externally, the shells of this group appear smooth, but internally, especially near the margin, the faint radials of *Terebratulina* are visible.

Dall gives a poor description of the loop of this species. As seen by our figure 18, the brachial support consists of long and narrow crura of nearly the same length as the loop itself. The latter is formed of a ring of broad lamellae in the shape of a closed horseshoe. There is a small cardinal process at the apex. Figure 18a illustrates the apical portion of the ventral valve showing the long pedicle-collar and the incomplete deltidia. The specimen figured is possibly not quite adult. Figure 17 shows the outline and smooth exterior of the ventral valve.

The 'Siboga' specimens extend the range of the species well to the south-east.

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1) „Diese neue Art stimmt im allgemeinen Habitus mit der Mittelmeerform der *T. caput serpentis* überein, ist aber etwat flacher und breiter. Es finden sich charakteristische Unterschiede im Bau des Armgerüstes, auf die hier nichs näher eingegangen werden kann . . . . " (p. 607).

3. *Terebratulina callinome* Dall 1920. Pl. I, figs 10, 10a, 11.

Terebratulina callinome Dall. Proc. U. S. Nat Mus., vol. 57, 1920, pp. 303—4.

Stat. 105. North of Sulu Island. 275 metres. Coral bottom, No. 14, 1 specimen; No. 16, 2 specimens; No. 18, 13 specimens; No. 19, 6 specimens.

Remarks. — This species was described, but not figured, by Dall in 1920 from specimens dredged at Cebu, Philippines, in 310 fathoms. A number of other localities are given by the same authority, including Borneo, Philippines, and Japan, with a range of depth from 68 to 448 fathoms.

The 'Siboga' specimens are poor. We figure a dead axample from lot No. 18. It has the following dimensions: — length, 12; width, 11; thickness, 5.5 mm., and is a much smaller shell than Dall's type, which measures 31 × 24 × 19 mm.

Figure 10 shows the form of the shell and the sculpture, which consists of fine radial grooves separated by wide and slightly raised interspaces, some of which bifurcate towards the periphery.

Figure 10a shows the large, incomplete foramen, the disjunct deltidia, and the distinct pedicle-collar.

Figure 11 illustrates the brachial support and hinge-processes. Bounding the dental-sockets are strong upstanding socket-ridges which project posteriorly like small ears. The crura are short; the loop is also short and formed of very broad lamellae; the transverse band has a distinct median fold.

Subfamily Terebratulinae Dall, 1870

6. Genus **Gryphus** Megerle von Mühlfeldt, 1811

1. *Gryphus borneoensis* Dall 1920. Pl. II, figs. 19—23.

Terebratula sp. Davidson, Voyage of H. M. S. Challenger, 1880, p. 32.
Gryphus borneoensis Dall. Proc. U. S. Nat. Mus., vol. 57, 1920, p. 314.

Stat. 95. Pearl Bank, Sulu Is. 522 metres. Stony bottom. No. 61, 1 specimen (small, damaged). ? sp.
Stat. 105. North of Sulu Is. 275 metres. Coral bottom. No. 29, 1 specimen; No. 28, 1 specimen (immature).
Stat. 177. Ceram Sea. between Misool and Ceram. 1633—1300 metres. Dead coral and stones. No. 27, 1 specimen (immature). ? sp.
Stat. 262. Kei Is. 560 metres. Solid bluish-grey mud, upper layers more liquid and brown mud. No. 30, 3 specimens.

Remarks. — This species was described, without figures, by Dall in 1920 from 1½ specimens dredged in 305 fathoms south of Silungan Island, Sibuko Bay, Borneo. A single valve was also obtained at a station in Jolo Sea, 508 fms; and another single valve at Molucca Pass, 272 fms.

A large specimen, No. 29, from the 'Siboga' Station 105 (North of Sulu Is.) is figured here (Pl. II, figs. 19—23). It measures: length, 39; width, 28; thickness, 22 mm., and is only a little smaller than Dall's type, 41 × 33 × 25 mm., which is from the same general region.

Figures 19, 20, and 21, on Plate II, show the general shape, thickness and broad folding of the species. A few fine radial threads cover the surface. These are difficult to show in a figure.

Figure 22 shows the apical portion of the ventral valve with the well-marked pedicle-collar

inside the large epithyrid foramen; also the libiate or spout-like character of the latter, masking the conjunction of the deltidial plates.

Figure 23 illustrates the small but distinct cardinal process, the dental sockets, the very wide, concave crural-plates descending to the broad transverse band of the loop, the upper border of which is medially notched. One crural point is broken off. The length of the brachial support is about 9 mm., or about ¼ the length of the dorsal valve.

As noted by Dall, this species recalls *G. bartletti* Dall, described from Barbadoes, 73 fathoms. It also resembles *G. stearnsi* Dall and Pilsbry, from the east coast of Japan, but it is sufficiently distinct from both of these.

The 'Siboga' Stations 95 and 105 are in the neighbourhood of the type station for the species; Station 262, Kei Islands, is far to the south-east, thus showing an extension of the range of the species beyond the Molucca Pass, recorded by Dall.

The specimen No. 61 from Station 95, Sulu Is., 522 M., consists of small apical fragments of the ventral and dorsal valves of a *Gryphus,* probably of this species.

The specimen No. 27 from Station 177, Ceram Sea, is very immature, and it is only with considerable doubt that it is referred to *G. borneoensis.* It was dredged from a greater depth than the others, and very possibly belongs to the next species, *G. translucidus* Dall.

Davidson, in his 'Challenger' Report (1880, p32) refers to a specimen of a *Terebratula* not sufficiently complete for identification which was dredged at Station 195, in October 1874, lat. 0° 48′ S., long. 126° 58′ E., at a depth of 825 fathoms. The position is Molucca Passage. This may be *Gryphus borneoensis* Dall.

2. *Gryphus translucidus* Dall 1920. Pl. I, figs. 4, 5, 5a.

Gryphus translucidus Dall. Proc. U. S. Nat. Mus., vol. 57, 1920, p. 320.

Stat. 105. North of Sulu Is. 275 metres. Coral bottom. No. 32, 1 specimen (young); No. 33, 2 specimens.

Remarks. — This small species, which has some resemblance to *G. affinis* (Calcara) from the Mediterranean, was described (without a figure) by Dall in 1920 from examples dredged at the Tawi-Tawi Islands, in 49 fathoms. He also records it from the same place from 340 fathoms; off Sibuko Bay, Borneo, 292 fms.; Gulf of Boni, Celebes, 540 and 700 fms.; and other places in the Philippines. It seems to range in depth from 49 to 700 fms., and to have a fairly wide distribution.

The 'Siboga' specimens are small and one is juvenile. One example from lot No. 33 is figured here (Pl. I, figs. 4, 5 and 5a). Figure 4 shows the ventral valve: the anterior border is slightly damaged. Figure 5 shows the loop and hinge-processes. In Dall's specimen there was no trace of a cardinal process. In our example there is a small but distinct cardinal process. The crural-plates are short and broad. The loop is somewhat indistinct owing to the presence of a part of the dried animal. Figure 5a shows the short beak, round foramen, well-marked pedicle-collar (not mentioned by Dall), and disjunct deltidial plates; also the small teeth. Our specimen is not quite adult, though it is larger than Dall's type, which measures: length, 7; width, 5.5; thickness, 4 mm.

Family Terebratellidae King, 1850

Subfamily Dalllininae Beecher, 1893

7. Genus Campages Hedley, 1905

1. *Campages asthenia* Dall 1920. Pl. I, figs. 1, 1a, 2 and 3.

Campages asthenia Dall. Proc. U. S. Nat. Mus., vol. 57, 1920, p. 365.

Stat. 59. Western entrance of Samau Strait (West of Timor). 390 metres. Coarse coral-sand with small stones. No. 34, 1 specimen (young).
Stat. 122. Celebes Sea, North of Menado. 1264—1165 metres. Stone bottom. No. 38, 2 specimens.
Stat. 280. West of Letti Is., N. E. of Timor. 1224 metres. Dredge brought up glossy black manganese nodules. No. 37, 2 specimens; No. 39, 2 specimens (in fragments); No. 40, 1 specimen (young).

Remarks. — This species was described by Dall, in 1920, without a figure, from a specimen dredged off Jolo, Philippines, in 318 fathoms. Two valves were also recorded from Sibuko Bay, Borneo, 347 fathoms.

The 'Siboga' specimen, No. 38, which is figured here (Pl. I, figs. 1—3) comes from Station 122, to the south-east of the type-station. It measures: length, 23; width, 24.5; thickness, 15 mm., and is larger than the type-specimen, which is described as subrectangular and moderately elongated. In its triangular shape, the 'Siboga' specimen recalls a large *Dallina floridana* (Pourt.) from Florida. It is very broadly intraplicate (figs. 1 and 3), and has a loop like that of *Campages furcifera* Hedley, from New South Wales. The foramen is circular and completed by conjunct deltidial-plates; the beak has no ridges; and the beak-cavity is without dental-plates.

The smaller specimen from the same locality is broadly sulcate: there are no dental-plates. It possesses a *Campages* loop; also beak and foramen of the larger specimen.

Figures 1, 2 and 3 of our plate, show the general shape of our specimen: figure 1a illustrates the apical portion of the dorsal valve. There is a distinct, bilobed and rugose cardinal process (Dall speaks of a small cardinal process). The cardinal platform is complete right across and not divided. It is supported by a high median septum, which descends two-thirds of the valve and is stepped towards the posterior end. The loop is, unfortunately, broken away at the crural-points, but the detached part shows the essential characters of *Campages*.

With the exception of the immature example from Station 59, the 'Siboga' specimens are from greater depths than those recorded by Dall. Stations 59 and 280 extend the range of the species well to the south.

2. *Campages basilanica* Dall 1920.

Campages basilanica Dall. Proc. U. S. Nat. Mds., vol. 57, 1920, p.p. 365—6.
id. id. id. Hatai, The Venus, vol. VI. (3), August 1936, p. 149, pl. 5, figs. 25—28.

Stat. 105. North of Sulu Is. 275 metres. Coral bottom. No. 63, 5 small specimens.
Stat. 251. Kei Is. Arafura Sea. 204 metres. Hard coral sand. No. 41, 1 specimen.

Remarks. — Dall gives the type locality as Kagoshima Gulf, Japan, 103 fathoms. He also records the species from Japan Sea, 361 fms; Korea Strait, 59 fms; Balabac Is., Philippines, 68 fms.;

Off Basilan, Philippines, 78 fms.; Tawi-Tawi Is., 240 fms.; Off North Burias, Philippines, 105 fms.; Off Jolo, Philippines, 161 fms.; Off West Luzon, 170 fms.; Off Celebes, 700 fms.; and Off Pratas Island, China Sea, 122, 150 and 230 fms.

This species was not figured by Dall, but Kotora Hati (The Venus, vol. VI., (3), August 1936, p. 149, pl. 5, figs. 25—28), has recently figured a specimen, in four views, under this name, which was dredged, along with others, in Wakasa Bay, Hukui Prefecture, Japan. He also records the species from the west coast of Kyûsyû to Sagami Bay, Korea Strait to Wakasa Bay. The depths given are from 58 to 119 metres.

The 'Siboga' specimens appear to agree closely with Dall's description, and resemble Hatai's figures of the Wakasa Bay example. Those from Station 105 (not far from Dall's localities of Tawi-Tawi Is., and Basilan) are yellowish in colour, the folding being sulcate to slightly intraplicate in larger specimens. They are small, the largest being 11 × 9 mm. Dall's type measures 14 × 11 mm. In the ventral valve there are no dental plates, but there is a very narrow fused pedicle-collar in some. The foramen is incomplete; beak, mesothyrid; deltidia, disjunct to conjunct. In the dorsal valve, the cardinalia are of the *Dallina* and *Campages* type, i. e. narrow, excavate hinge-plates, supported by a thin septum: latter slightly high at the union of the transverse processes. The loops are all imperfect, but what remains show the *Campages* characters.

The 'Siboga' specimen from Station 251 is like the others, only pure white. It has a typical *Campages* loop and cardinalia. Its dimensions are: length, 10.5; width, 8 mm. The folding is slightly intraplicate. The presence of the species at the Kei Is., extends the range considerably to the south-east. The species seems to follow the various archipelagoes off the coast of Asia.

8. Genus **Jolonica** Dall, 1920

1. *Jolonica hedleyi* Dall 1920. Pl. II, figs. 24—27.

Campages (Jolonica) hedleyi Dall. Proc. U. S. Nat. Mus., vol. 57, 1920, pp. 366—7.
Jolonica hedleyi Dall. Thomson, Brachiopod Morphology and Genera (Recent and Tertiary), 1927, pp. 248—9.

Stat. 105. North of Sulu Is. 275 metres. Coral bottom. No. 43, 2 specimens (1 damaged); No. 60, 1 specimen (young).

Remarks. — Dall described the species under *Jolonica* as a section of *Campages*. The type and only station given for the species is, "Off Jolo, Philippines, in 318 fathoms, sand; one specimen and a fragment." The species was not figured.

In lot No. 43 of the 'Siboga' dredgings at Station 105 (near the type station) there is a large shell (Pl. II, figs. 24—27) with the following dimensions: length, 26.4; width, 23.4; thickness, 15 mm. This is larger than Dall's type of 18 × 18 × 9.5 mm. The ventral valve is deeper than the dorsal; the foramen is rather worn and incomplete; the folding is ventrally uniplicate, i. e. broadly sulcate. In the ventral valve the foramen is permesothyrid; deltidia, disjunct? (broken); good dental plates (with cavities) supporting fairly strong teeth; fused pedicle-collar, closely applied to the floor of the beak-cavity, reaching to the front end of the dental plates, and striated longitudinally; no median septum, only a low ridge separating strong muscle imprints in the posterior third of the valve; densely punctate with small oval pores; valve very convex. In the dorsal valve the cardinalia are of the

Jolonica and *Frenulina* type, not the *Campages* type: they consist of deep dental-sockets with over-hanging socket-ridges; crural-bases, which commence a little way from the apex, separated from the socket-ridges by a groove; no inner hinge-plates; cardinal process bilobed and rugose; median septum extending from umbonal-cavity to two-thirds the length of the valve, not united with the cardinalia, rather sharp and high at the union with the transverse processes of the loop; latter with descending branches fairly broad, diverging from the middle line, and united to the septum by narrow transverse processes; ascending portion consisting of a thin broad ribbon extending from the transverse processes to the ends of the descending branches and forming a large hood or funnel with wide opening in front and a narrow opening behind; no lacunae occur in the hood. The loop is essentially that of *Campages furcifera* (but cardinalia and other features distinct) and of *Frenulina sanguinolenta* (in which the cardinalia almost agree) (see our fig. 27). In *Jolonica,* according to Dall's description, the hood is similar to that of our specimen, but is closed posteriorly by a calcareous plate.

The young specimen, No. 60, from Station 105, shows a very young lenticular stage: the ventral valve has small dental plates.

Figures 24, 25 and 26 show the general outline and thickness of the shell, No. 43.

9. Genus **Frenulina** Dall, 1894

1. *Frenulina sanguinolenta* (Gmelin 1791).

Anomia sanguinea, etc., Chemnitz. Conch. Cabinet, vol. 8, 1785, p. 96, pl. 78, fig. 706.
Anomia sanguinolenta Gmelin. Linn. Syst. Nat., 13th ed., vol. I, pt. VI, 1791, p. 3347.
Megerlia sanguinea (Chemnitz). Davidson, Mon. Recent Brach., pt. 2, 1887, p. 108, pl. 20, figs. 1—8.
Frenulina sanguinolenta (Gmelin). Dall, Proc. U. S. Nat. Mus., vol. 57, 1920, p. 336.
id. id. Thomson, Brach. Morph. and Genera (Recent and Tertiary), 1927, p. 241.
Frenulina sanguinea (Chemnitz). Leloup, Mem. Mus. Roy. d'hist. nat. de Belgique, vol. II, fasc. 13 (2 et 3), 1933, p. 11.
Frenulina sanguinolenta (Gmelin). Hatai, The Venus, vol. VI, No. 1, March 1936, pp. 1—14, pl. I, figs. 1—9, pl. II, figs. 1—2, and text-figure 1.

Stat. 65a. Tanah Djampeah, south of Saleyer, south of Celebes. 400—120 metres. Mud and coral bottom. No. 50, 1 specimen (in fragments).
Stat. 93. Pulu Sanguisiapo, Tawi-Tawi Is., Sulu Archipelago. 8—10 metres. Lithothamnion, sand and coral. No. 48, 38 specimens (some young); No. 51, 1 specimen.
Stat. 96. South-east side of Pearl Bank, Sulu Archipelago. 15 metres. Lithothamnion. No. 49, 2 specimens.
Stat. 99. North-Ubian, Sulu Archipelago. 16—23 metres. Lithothamnion bottom. No. 45, 2½ specimens; No. 46, 2 specimens; No. 53, 1 specimen.
Stat. 109. Pulu-Tongkil, Sulu Archipelago. 13 metres. Lithothamnion bottom. No. 47, 2 specimens; No. 57, 1 specimen.
Stat. 144. North of Salomakiee-(Damar) Island. 45 metres. Coral bottom and Lithothamnion. No. 52, 2 specimens.
Stat. 257. Du-roa Strait, Kei Is. 52 metres. Coral. No. 55, 4 specimens.
Stat. 260. North Point of Nuhu Jaan, Kei Is. 90 metres. Sand, coral and shells. No. 54, 7 specimens.
Stat. 262. Near Kei Is. 560 metres. Solid bluish-grey mud, upper layer more liquid, and brown mud. No. 30a, 1 specimen.
(?). Lamakera, east end of Flores Is. Depth? No. 56, 1 specimen.

Remarks. — The first valid binomial name for this species is that of Gmelin, viz. *sanguinolenta,* in Linn. Syst. Nat., 13th ed., vol. I, pt. VI, 1791, p. 3347. Chemnitz, a non-binomial writer, called it *"Anomia sanguinea",* etc., in Conch. Cab., vol. 8, 1785, p. 96, pl. 78, fig. 706. On p. 71 of the same work, in his Index to Plates, he gives *"Anomia sanguinea"* only. He was not consistently bi-nomial. Schröter, in 1788, in "Vollständiges alphabetisches Namen-Register über alle zehn Bände des ... systematischen Conchylien Cabinets" (von Martini und Chemnitz), gives *"Anomia sanguinea"*. This being an index name only, it cannot he considered as making Chemnitz's name bi-nomial: besides, Schröter, again, is not strictly bi-nomial. Notwithstanding these facts, Leloup, in a recent memoir (op. cit., 1933) stresses the adoption of Chemnitz's name.

This species has a very extended range in the Pacific region, having been recorded from many places, from Australia and New Zealand in the south to Japan and China Sea in the north. It is reported to range into the Indian Ocean, as Leloup (op. cit. p. 13) records a specimen in the Dautzenberg-collection from the Island of Mauritius, brought back by Commandant Liénard. We would suggest that the specimen in question might be *Kraussina pisum* (Lam.), which was originally described from Mauritius. A good figure of the latter is given by Sowerby, in Thesaurus Conch., vol. I, 1846, p. 345, pl. 69, figs. 37—39. Sowerby (op. cit., p. 360, pl. 71, figs. 105—7), mentions and figures *Frenulina sanguinolenta* (as *pulchella* Sow.) from the Island of Cocos (Lt. Swainson), but whether the island of that name in the Pacific or that in the Indian Ocean is not stated. Leloup takes it for the latter.

As seen by our list above, the 'Siboga' Expedition dredged the species at many places in the East Indies, at depths varying from 8—10 metres (= 4—5 fathoms) to 560 metres (= 306 fms). The greater number of examples occurred at the smaller depths, as for example Station 93, Pulu Sanguisiapo, Tawi-Tawi Is., where 38 specimens (young and old) were dredged in 8—10 metres. The loops in these show various developmental stages, from a pre-ismeniform stage (3 mm.), through an early frenuliniform stage (3.5 mm.), to the adult or frenuliniform stage (7—8 mm.). In view of Hatai's recent work (op. cit., pp. 6—8) on the loop-stages of the species, no object would be served in repeating the observations here.

Leloup (op. cit., pp. 12—13), records the species on corals from Banda Neira, south of Ceram, 2—3 metres (= 1—1½ fathoms); 2 examples, length, 9; width, 10 mm., and 45 examples, length, 11; width, 11 mm.: also between Banda Neira and Goenoeng, 5 metres (= about 2½ fathoms); 5 examples length, 10; width, 11 mm.

Dall (op. cit., 1920, p. 337), gives the range in depth as from 10 fathoms to 318 fathoms, 25 examples being taken in 17 fathoms at one station, off Tawi-Tawi Islands. He records the species from several places in our region.

In this widely-distributed species, there is much variation in the red colour-pattern. As pointed out by Hatai (op. cit., p. 5), the colouration may be divided into two groups. The first group is represented by Sowerby's *pulchella* and includes forms which have the divaricating or plain streak or a longitudinal series of red splashes at the margin of the shell. The second group is represented by Sowerby's *sanguinea* where the whole surface of the shell is decorated with irregular red dots or splashes (See Sowerby, Thes. Conch., vol. I, 1846, p. 360, pl. 71, figs. 105—7, for *pulchella*; and p. 357, pl. 71, figs. 71—73, for *sanguinea*). As regards the colour of the 'Siboga' specimens, they all appear to agree with Sowerby's *sanguinea.*

10. Pictothyris? Pl. II, figs. 34—37.

Stat. (?). Sebankatan. No. 66, 1 specimen (? sub-fossil).

Remarks. — This specimen consists of the apical fragments of the ventral and dorsal valves. The cardinalia of the dorsal valve and the beak-cavity of the ventral valve are much thickened by calcification. Little can be done with regard to precise determination owing to the imperfect material.

Figures 34 and 35 show the outer and inner aspects of the apical parts of the ventral valve. The beak is suberect; foramen mesothyrid? (it is very worn); deltidial plates are broken away. The hinge-teeth are very strong with swollen bases (probably due to excessive calcification). The beak-cavity has a very deep muscle impression.

Figures 36 and 37 show the outer and inner aspects of the apical parts of the dorsal valve. There are deep dental-sockets, bordered internally by heavily calcified socket-ridges and crural bases. The hinge-plate is divided; the cardinal process is bulbous and situated at the apex of the thickened median septum. The type of cardinalia is not that of *Laqueus* or *Dallina,* but seems to be nearer that of *Pictothyris.*

Stat. (?). Sebankatan. No. 67, 1 specimen (fragmentary).

Remarks. — This consists of the apical parts of a small ventral and dorsal valve. The ventral valve shows an incomplete mesothyrid foramen with disjunct deltidia. The hinge-teeth are strong and bulbous, and without dental-plates. The beak-cavity shows a very deep muscular impression. The dorsal valve has a divided hinge-plate with thick socket-ridges bordering the dental-sockets. There is a small cardinal process at the apex of a median septum, which is stepped at the attachment of the transverse band of the loop. The latter is broken and all that remains are the descending branches, which are united to the septum by the transverse band. The loop appears to be in a frenuliniform stage. On the whole, this imperfect specimen, like the last, suggests reference to some genus as *Pictothyris.*

Stat. 6— (?). (Label damaged). No. 44, 1 specimen.

Remarks. — This is a smooth, white shell, conspicuously punctate: it is lenticular, with incipient sulcation anteriorly. The dimensions are: length, 15; width, 14 mm. The foramen is mesothyrid; deltidia, conjunct; fairly large hinge-teeth with strong, swollen bases; narrow, fused pedicle-collar; beak-cavity much thickened at the sides surrounding a deep central muscular pit. In the dorsal valve the cardinalia are much thickened and seem to be of the *Pictothyris*-type; cardinal process, prominent; strong socket-ridges with inner sides descending to the floor of the beak-cavity; thick median septum, stepped at the transverse band of the loop. This seems to be the same species as No. 67, above, only larger.

Stat. 9 — (?). (Label in fragments). No. 59, 3 specimens (small).
Stat. 12. Bali Sea, north of Bali. 289 metres. Mud and shells. No. 31, 1 fragment (too indefinite); No. 58, 2 specimens (small and imperfect).

Remarks. — The above appear to be young, lenticular stages of Dallinoids of some kind, perhaps of the *Pictothyris* group.

11. ? Terebratalia sp.

Stat. 105. North of Sulu Is. 275 metres. Coral bottom. No. 62, 1 specimen (very young).

Remarks. — This is a very young ribbed shell of a long-looped form. The ventral valve does not possess dental plates. In the dorsal valve the loop is in the ismeniform stage (cf. Thomson, 1927, p. 236, fig. 75 *e—f*). The shell is too small for accurate determination. It may be a very young example of a *Terebratalia* or *Coptothyris*.

BIBLIOGRAPHY

1908. Blochmann, F., Zur Systematik und geographischen Verbreitung der Brachiopoden. Z. f. w. Z. Bd. 90.

1916. Böggild, O. H., Meeresgrundproben der Siboga Expedition. Siboga-Expeditie. Leiden, 65. Mon.

1920. Dall, W. H., Annotated list of the recent Brachiopoda in the collections of the U. S. National Museum with descriptions of thirty-three new forms. Proc. U. S. National Museum, Washington. Vol. 57.

1880. Davidson, Thom., 1880, Report on the Brachiopods dredged by H. M. S. Challenger during the years 1873—1876. Challenger-Rep. Zoolog. Vol. I.

1886/88. —— A monograph of recent Brachiopoda. Trans. Linnean Soc. London, ser. 2, Vol. 4.

1921. Jackson, J. W., On the occurrence of Lusitanian Brachiopods in the Persian Gulf. Ann. Mag. Nat. Hist. ser. 9. Vol. VII.

1933. Leloup, E., Brachiopodes. Mem. du Musée Royal d'histoire naturelle de Belgique. Vol. II.

1923. Mortensen Th., The danish expedition to the Kei islands 1922. Vidensk. Medd. Dansk naturh. Foren. Kopenhagen, Bd. 76.

1887. Oehlert, D. P., Brachiopodes. In: P. Fischer, Manuel de conchyliolochie.

1931. Pannekoek, A. J., Brachiopoda. Leidsche Geolog. Mededeel. Deel V, Feestbundel K. Martin.

1929. Schuchert Charles et Clara M. le Vene, Brachiopoda. (Generum et genotyporum Index et bibliographia). Fossilium catalogus. Pars 42.

1933. Stiasny, G., Verzeichnis der Brachiopoden-Sammlung des Naturhistorischen Reichsmuseums in Leiden, Zoolog. Mededeel. Deel XV.

1934. —— Nachtrag zum Verzeichnis des Brachiopoden-Sammlung des Naturhistorischen Reichsmuseums in Leiden, ibid. Deel XVII.

1927. Thomson, J. A., Brachiopod morphology and genera (recent and tertiary). New Zealand board of sc. a. art. Man. 7. Wellington.

EXPLANATION OF THE PLATES

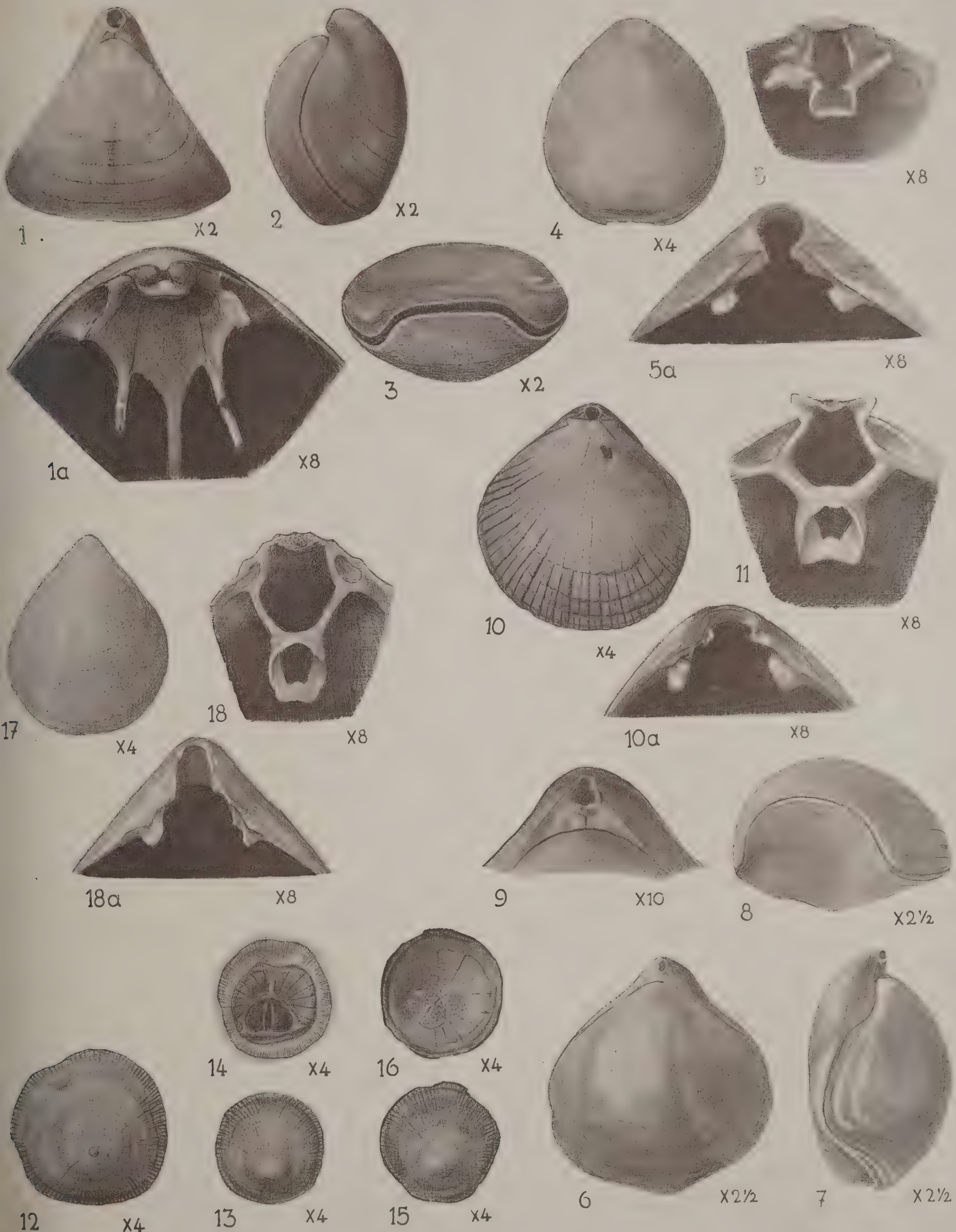
THE DRAWINGS WERE MADE FROM NATURE

BY

Mr. I. F. OBBES

PLATE I

Fig. 1. *Campages asthenia* Dall. Dorsal view. × 2.
Fig. 1a. „ „ Cardinalia. × 8.
Fig. 2. „ „ Lateral view. × 2.
Fig. 3. „ „ Anterior view. × 2.
Fig. 4. *Gryphus translucidus* Dall. Ventral view. × 4.
Fig. 5. „ „ Interior of the dorsal valve. × 8.
Fig. 5a. „ „ Interior of the ventral valve. × 8.
Fig. 6. *Basiliola pompholyx* Dall. Dorsal view. × 2½.
Fig. 7. „ „ Lateral view. × 2½.
Fig. 8. „ „ Anterior view. × 2½.
Fig. 9. „ „ Foramen, etc. × 10.
Fig. 10. *Terebratulina callinome* Dall. Dorsal view. × 4.
Fig. 10a. „ „ Interior of the ventral valve. × 8.
Fig. 11. „ „ Loop. × 8.
Fig. 12. *Discinisca stella* (Gould). Upper valve × 4.
Fig. 13. „ *keiensis* sp. nov. Upper valve. × 4.
Fig. 14. „ „ Lower valve. × 4.
Fig. 15. „ „ Upper valve. × 4.
Fig. 16. „ „ Lower valve. × 4.
Fig. 17. *Terebratulina photina* Dall. Ventral view. × 4.
Fig. 18. „ „ Loop × 8.
Fig. 18a. „ „ Interior of the ventral valve. × 8.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X2
2
X2
4
X4
5
X8
1a
X8
3
X2
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11
X8
17
X4
18
X8
10a
X8
18a
X8
9
X10
8
X2½
14
X4
16
X4
6
X2½
7
X2½
12
X4
13
X4
15
X4

PLATE II

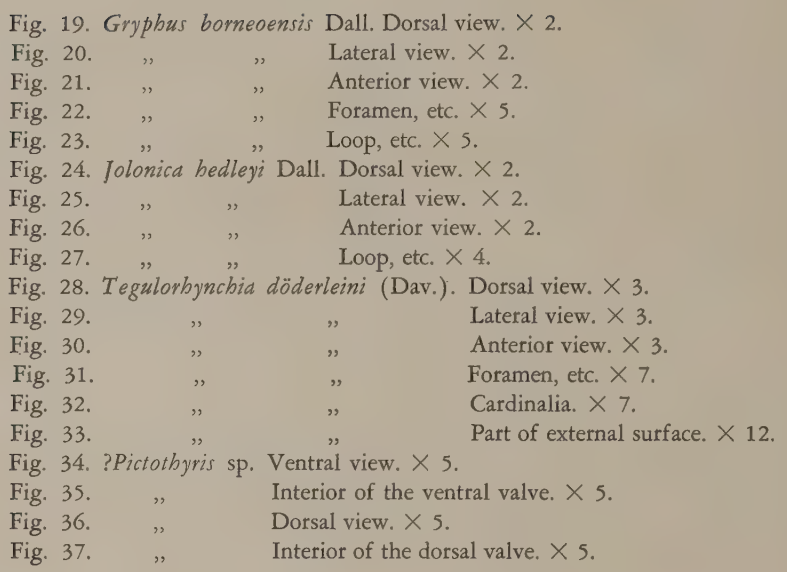
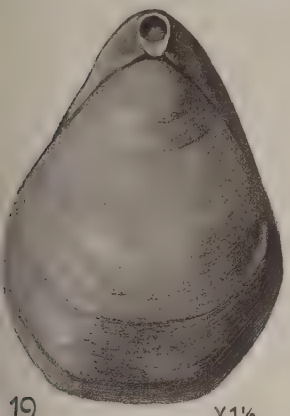


Fig. 19. *Gryphus borneoensis* Dall. Dorsal view. × 2.
Fig. 20. ,, ,, Lateral view. × 2.
Fig. 21. ,, ,, Anterior view. × 2.
Fig. 22. ,, ,, Foramen, etc. × 5.
Fig. 23. ,, ,, Loop, etc. × 5.
Fig. 24. *Jolonica hedleyi* Dall. Dorsal view. × 2.
Fig. 25. ,, ,, Lateral view. × 2.
Fig. 26. ,, ,, Anterior view. × 2.
Fig. 27. ,, ,, Loop, etc. × 4.
Fig. 28. *Tegulorhynchia döderleini* (Dav.). Dorsal view. × 3.
Fig. 29. ,, ,, Lateral view. × 3.
Fig. 30. ,, ,, Anterior view. × 3.
Fig. 31. ,, ,, Foramen, etc. × 7.
Fig. 32. ,, ,, Cardinalia. × 7.
Fig. 33. ,, ,, Part of external surface. × 12.
Fig. 34. ?*Pictothyris* sp. Ventral view. × 5.
Fig. 35. ,, Interior of the ventral valve. × 5.
Fig. 36. ,, Dorsal view. × 5.
Fig. 37. ,, Interior of the dorsal valve. × 5.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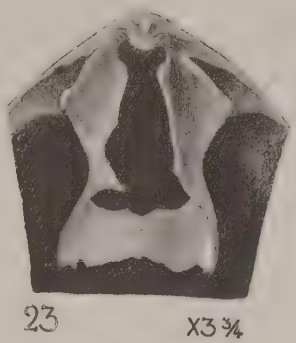
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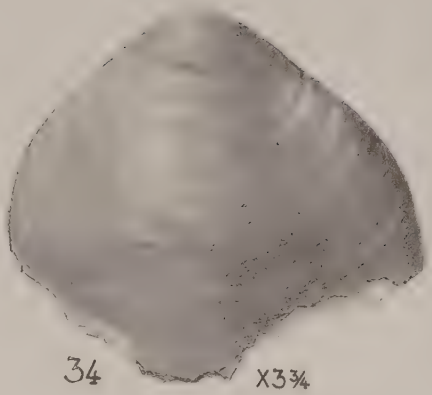
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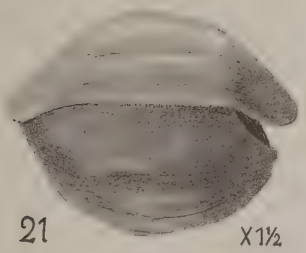
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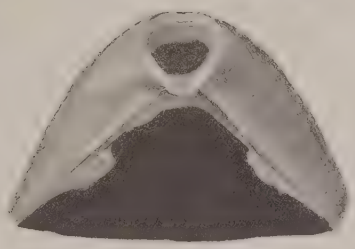
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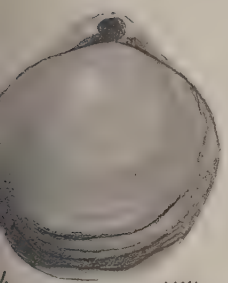
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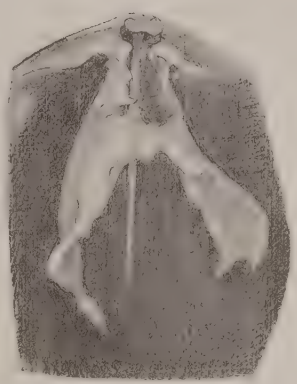
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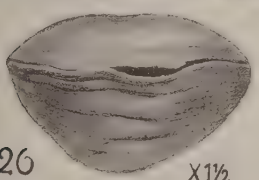
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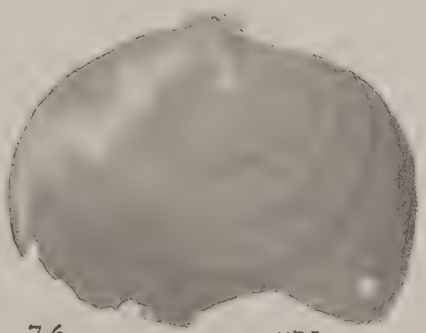
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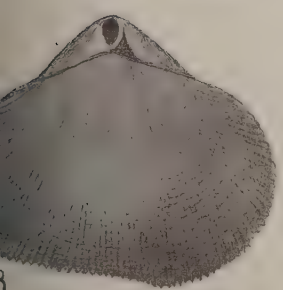
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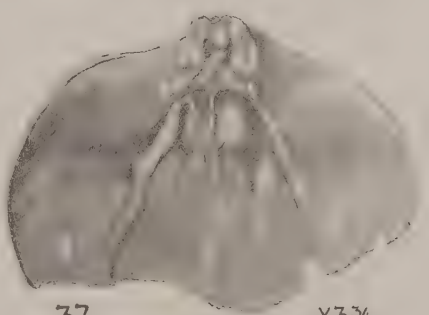
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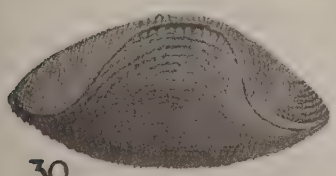
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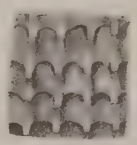
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SIBOGA-EXPEDITIE

RÉSULTATS DES EXPLORATIONS ZOOLOGIQUES, BOTANIQUES, OCÉANOGRAPHIQUES ET GÉOLOGIQUES

ENTREPRISES AUX INDES NÉERLANDAISES ORIENTALES EN 1899—1900

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